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DARTONFIELD GROUP — VISITORS' DAY

Those who wish to visit the Institute are requested to do so after making an appointment. No special days are set apart as Visitors' Days and the services of the technical officers can be availed of for discussion or demonstration only by prior appointment.

PUBLICATIONS

Rubber Research Institute publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of rubber estates in Ceylon over 10 acres in extent. Forms of application can be supplied to the Superintendents of large estates for the use of their assistants.

It will be appreciated if subscribers will return any back publications which are of no use to them.

ADVISORY CIRCULARS

The undernoted Circulars may be obtained on application at 30 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :—

(1) Notes on Budgrafting Procedure (Revised May, 1952).
(5) Straining box for latex (January 1940).
(6) Notes on the care of Budded Trees of Clone Tjirandji 1 with special reference to Wind Damage (Sept. 1938).
(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).
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(31) Root Disease in Replanted Areas (Superseding Circular No. 10) (Oct. 1951).
(32) Crown Budding for Oidium Resistance (October 1951).
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(39) Clonal Seed as Planting Material (Superseding Circulars No. 26 & 27) (July 1953).
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FACTORY WATER SUPPLIES. PART I — THE INFLUENCE OF CERTAIN WATERS ON THE LAMINATION OF SOLE CREPE LACES

By

E. J. Risdon, Chemist, M. Nadarajah, Research Assistant and the Staff of the Chemical Dept.*

Introduction:

THE influence of the quality and of the supply of water for various industries, including some connected with or related to the natural rubber industry, *e.g.* carbon black manufacture, cellulose plastics manufacture is now well known. It is questionable whether detailed attention has invariably been given to the quality of the factory water supplies in the raw rubber producing industry, although there are many statements in the literature to the effect either that good quality water should always be available or that poor quality water should only be used very sparingly, if at all, (2,3,5,6,13,14) and that the presence of calcium in standardisation water can lead to process difficulties (2,7). However, the influence of certain elements e.g. copper and manganese, [which would not normally be expected to occur in factory waters in appreciable quantities in Ceylon, although one case of high manganese content is reported from Malaya (8)], upon the properties of natural rubber is well known (4,12 **et al**) and more recently the importance of magnesium in latex concentrates has been emphasised (9).

The present authors hope to publish a limited number of short articles in this journal dealing with various aspects of the subject of factory water supplies for raw rubber production, with special reference to Ceylon. This article discusses the influence of certain waters on sole crepe lamination mainly in laboratory type experiments.

2. Commercial Lamination of Sole Crepe :—In Ceylon probably not less than about 60 Estates have manufactured and sold a considerable portion of their latex rubber as opposed to their scrap rubber, in the form of sole crepe. Almost invariably a fractional coagulation process in the presence of sodium bisulphite with or without the addition of RPA.3 bleaching agent, is followed. Beyond this point in the process there is considerable diversity in commercial practice; thus, some Estates mill the main bulk of their coagulum on the day following coagulation whereas certain others do not carry out this milling until 2 days after collection of the latex. Where practicable, Estates seem to prefer to mill using the Wet (Malayan) process, but in many cases due to the shortage of mills of the appropriate type and size or of water the Intermediate or the Dry (Ceylon) Processes may be followed. After drying, cutting out dirt particles with scissors and patting, the laces are laminated by one to three passes through old smooth sheet or other mills, suitably erected and geared. Preheating of the patted laces on a hot water table is at present believed to be unusual and unnecessary in all but a small number of Estates located in the Matale District of the Central Province.

The Superintendent of one of these Estates, the late Mr. Gordon Duff, pointed out that in his opinion the use of a hot water table prior to lamination gave rise to appreciable discolouration in his sole crepe and requested the R.R.I.C. to investigate whether the use of a hot table could be avoided.

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Mr. Gordon Duff considered that his factory water was medium to hard and suggested that the quality of the water at milling might be one of the principal factors governing ease of lamination.

3. Experiments carried out by or with the R.R.I.C.—In the early stages of the tests with one of the Estates (Warriapolla Estate, Matale) samples of dried sole crepe laces were exchanged between the Estate and the R.R.I.C., but Warriapolla laces could not be adequately laminated at the R.R.I.C., although R.R.I.C. laces could be laminated at Warriapolla. Since R.R.I.C., sole crepe has not recently, if ever, been criticised on the basis of poor lamination, the experiment suggested that the laminating procedure at Warriapolla was not unsuitable judged by 'low country' standards or, at worst, no more unsuitable than the R.R.I.C. procedures. At about the same period (Nov. 1951), arrangements were made at Warriapolla to collect a considerable volume of rain water from the factory upper roof and use this in the nip in the last smooth milling of the laces. Mr. Gordon Duff reported to the effect that laces given 1 or 2 passes with rain water on the final smooth mill immediately before drying could be laminated without heat and appeared quite as satisfactory from the view-point of lamination as his normal process material laminated with a hot table. Further, the sole crepe samples made without a hot table were reported to be better and, particularly, brighter in colour than the samples made with a hot table.

From time to time partial analyses have been made, largely but not entirely by D. H. Constable, Agronomist, on milling waters selected by the R.R.I.C., at different factories. Table No. 1 summarises the results giving either the figures obtained, (or where more than 1 sample has been tested the range of values), in terms of parts per million of original water. The last column of the table gives a summary of the information available on ease of lamination of sole crepe laces at the particular Estate.

Table No. 1 Partial Analysis of Factory Milling Waters in p.p.m. of Original Water

Estate Name & District	Residue after Evaporation	Chloride	Silica	Calcium	Magnesium	Iron	Ease of Lamination
Bandarapola, Matale	144.274	< 1	60–65	46–55	16–18	< 1	C-3
Clodagh, ,,	150–266	8	30–35	13–21	7–8	< 1	C-1
Ross ,,	115–270	8–13	26–60	30–64	14–26	< 1	C-3
Selegama ,,	20	14	< 1	3	< 1	< 1	?
Suduganga ,,	280	37	36	29	16	—	?
Warriapolla ,,	394–450	14	32–60	43–123	15–44	< 1	C-3
Udapolla, Avissawella	29	—	4	—	< 10	< 1	A-1
Bentota, Elpitiya	24	—	4	< 1	< 10	< 1	A-1
Gallinda, Elpitiya	15	1	< 1	1	—	< 1	?
Perth, Horana	45	—	4	< 1	< 10	.6	A-1
Dalkeith, Kalutara	31	—	3.4	< 5	< 10	< 1	A-1
Dartonfield Kalutara	45	9	2–< 1	2	1		A-1
St. George, Kalutara	46–80	—	9–10	2–5	1	.02–.15	A-1
Tempo, Kalutara	30	< 1	13	< 1	—	—	A-1
Vogan, Kalutara	60	< 1	12	8	2	—	A-1
Vykumbra, Passara	—	—	—	52	—	1.4	?
Galbode, Ratnapura	—	—	20	—	—	—	A-1
Hapugastenne Ratnapura	35		7–34	< 1	< 1	.3	X

Key to the last column.

? No information on ease of lamination available. As far as is known only R.S.S. or blanket crepe are normally manufactured.

A–1 In general, no difficulties are found in lamination in the absence of a hot table under normal operating conditions.

A–2 Not making sole crepe at the time that the water samples were selected, but it is believed that these Estates could be classed as A–1.

C–1 Not equipped with a hot table, but lamination difficulties are encountered. A heavy laminating mill is employed and lamination is believed to be normally confined to the hottest parts of the day or week, as the case may be.

C–3 Equipped with a hot table which has to be used for large parts of the year.

For certain periods of the year it may be possible to dispense with the hot table.

X Lamination was considered defective by the Estate. Samples submitted to the R.R.I.C. broker were passed as satisfactory and we considered this correct. The Estate water does not appear abnormal in calcium or total solids, and silica tests on this and the next door Estate (Galbode) showed a higher figure for the latter (20 against 7 p.p.m.), when both were sampled on 1 day. It seems possible that the laminating mill may have been very slightly defective, but this is not yet certain to us.

The key to the last column of Table No. 1 is worded with some caution, because there is no intention to imply that peculiarities — chemical or biological — in the milling water is the sole factor concerned in the subject of ease of lamination. Other factors *e.g.* surface moisture content, type of mills etc. are known to be of great importance to the appearance of the finished sole crepe. Nevetheless the data in Table No. 1 and the experiments at Warriapolla clearly suggest that the quality of the milling water may be a major factor. Examination of the literature available to the authors (1,10, 11 **et al**) did not permit a clear-cut decision concerning which constituents of milling water would give rise to decreased tackiness or self adhesion in natural rubber sole crepe laces. However, the data of Table No. 1 lends some support to the view that calcium might be of major importance, possibly as a result of bicarbonate alkalinity. Determinations of the pH of certain factory waters on receipt and after storage have therefore been made using suitable electrical instruments.

Planters will find the meaning of the term, pH discussed by D. H. Constable in this Journal (**28** No. 3,4,p. 16) and for this purpose it is only necessary to point out that the pH is the negative logarithm to the base 10 of the hydrogen on activity, symbolically — Log. 10 (H), so that a low pH denotes acidity and a high pH alkalinity, the neutral point being about 7.

Table No. 2-p.H of Factory Milling Waters

Estate Name	Time of Testing in Days after Sampling in Jan. '53				Time of Testing in Days after Sampling in Mar. '53				Ease of Lamination
	0–1*	7–8	24–26	36–38	0–1*	2–3	6–8	18–22	
Ambatenne	7.19	7.04	7.42	—	6.82	—	7.61	—	A-1
Bandarapola	7.79	8.29	8.42	8.61	7.49	7.52	—	8.23	C-3
Clodagh	6.46	8.17	8.24	8.41	6.63	6.82	6.53	7.44	C-1
Culloden	6.79	7.37	7.22	7.28	6.59	6.78	7.14	7.06	A-1
Dalkeith	6.94	7.12	7.29	7.39	6.53	—	7.13	7.27	A-1
Dartonfield	6.35	6.28	7.09	—	—	—	—	—	A-1
Elkaduwa					5.95	—	7.58	—	A-1
Ellakande	6.26	7.39	7.48	7.51	6.51	6.89	7.41	7.59	A-1
Galbode					7.97	7.98	—	—	A-1
Glendon					6.66	—	7.12	7.10	A-1
Hapugastenne					7.49	7.56	7.55	7.51	X
Kudaganga	6.21	6.92	7.43	7.34	6.46	—	7.26	7.18	A-1
Mahawela					7.15	7.21	7.22	7.19	A-1
Malaboda					6.07	—	7.66	—	A-1
Neuchatel	6.95	7.65	7.51	7.52	6.83	7.00	7.59	7.34	—
Palm Garden					7.12	7.21	7.22	6.98	A-1
Pantiya	6.90	6.99	7.56	7.30	6.78	—	7.15	—	A-1
Perth	7.39	7.35	7.45	7.47	6.56	6.61	7.55	7.69	A-1
Pimbura	7.05	6.91	7.40	7.45	6.98	—	6.91	7.11	—
Ross	7.13	8.37	8.54	8.62	7.05	7.08	7.39	7.34	C-3
St. George	5.97	6.89	7.37	—	5.91	—	7.46	—	A-1
Tempo	7.35	7.55	7.42	7.39	7.19	7.22	7.25	7.50	A-2
Vogan	7.29	7.37	7.41	7.29	7.00	—	7.20	7.28	A-2
Warriapolla	7.98	8.35	8.29	8.51	7.65	7.89	7.41	8.29	C-3
Yatadola	6.45	7.41	7.83	7.72	6.65	—	7.65	7.49	—

The columns in Table No. 2 marked * show the relationship between the pH of the milling water tested shortly after receipt at Dartonfield and the ease of lamination at the appropriate Estate. No absolutely reliable clear cut relationship, such as the appearance of critical pH limits, inside which lamination is invariably difficult in the absence of a hot table, is apparent between these two factors from the data in Table No. 2 and if there is such a relationship it seems likely that transportation of the water samples in glass vessels has upset the pH values of these waters, which are probably only very lightly buffered under normal conditions.

It is to be noted, however, that when the pH is determined soon after sampling the values obtained for the milling waters, selected at Estates where lamination in the absence of a hot table can be difficult, are often but not invariably amongst the highest figures. This is illustrated below :—

Sampling in	Mean pH Values for All Estates Classed as A — 1	Classed as C–1, C–3 or X
Jan. '53	6.76	7.34
March'53	6.71	7.26

The difference between the mean figures does not appear to be statically significant in the Jan. '53 sampling and is only just significant at P = .05, not P = .01, in the March sampling. On the information at present available it is tentatively concluded that the use of the pH of the milling waters as a guide to the ease of lamination could be misleading.

A considerable number of small scale laboratory dipping experiments in which laces are soaked in aqueous solutions of various compounds for 10 minutes and/or overnight have been carried out in order to ascertain information on the significance of various ions likely to be present in factory waters. After soaking, the lace samples are dripped and dried in the normal manner and examined for ease of lamination and/or ease of deplying after lamination. While it would be premature to claim that a simple soaking test carried out for the correct length of time is invariably a reliable guide to the suitability of the water in the factory, tests made with the waters from a number of the Estates in Table No. 2 show at least a good qualitative correlation between behaviour in the factory concerned and small scale laboratory tests.

Table No. 3—Laboratory Lace Soaking Experiments

Compound in Solution	Concn. of Metal	pH of the Solution		Quality of Lamination of dried laces	
		before Soaking	after Soaking	10 mins. Soaking	Overnight Soaking
Calcium Bicarbonate, Carbonate	20 p.p.m.	7.49	7.38	Weak	Poor
	100 p.p.m.	8.10	7.63	Poor	Very Poor
Magnesium Bicarbonate, Carbonate	20 p.p.m.	6.29	6.40	Satisfactory	Satisfactory
	80 p.p.m.	6.68	6.85	Adhesion just satisfactory	Adhesion and surface poor
Sodium Carbonate	20 p.p.m.	9.30	8.73	Adhesion satisfactory	Satisfactory
	80 p.p.m.	9.97	9.43	Poor	Very Poor
	100 p.p.m.	10.36	10.28	Satisfactory	Satisfactory
Potassium Carbonate	20 p.p.m.	9.12	8.62	Satisfactory	Weak in places only
	80 p.p.m.	10.30	10.08	Satisfactory	Satisfactory
Calcium Chloride	20 p.p.m.	6.97	6.64	Almost satisfactory	Weak
	80 p.p.m.	6.14	5.76	Weak	Poor
	100 p.p.m.	5.31	5.23	Weak	Very Poor
Potassium Chloride	20 p.p.m.	5.55	5.17	Satisfactory	Satisfactory
	100 p.p.m.	5.69	5.46	Weak	Poor
Sodium Chloride	20 p.p.m.	5.65	5.34	Satisfactory	Satisfactory
	100 p.p.m.	5.93	5.86	Weak	Poor
Magnesium Nitrate	80 p.p.m.	5.39	5.37	Satisfactory	Satisfactory

Notes: 1. Calcium bicarbonate — carbonate and magnesium bicarbonate — carbonate solution have been made by adding the appropriate weight of the solid carbonate to water and passing carbon dioxide through the solution with occasional gentle shaking.

2. Quality of Lamination in descending order : Satisfactory, Just Satisfactory, Almost Satisfactory, Weak, Poor, Very Poor.

The data summarised in Table No. 3 clearly suggest that the presence of certain compounds in the waters used in small scale lace soaking experiments adversely affects the lamination. It is noted that calcium, probably mainly in the form of bicarbonate, has a most pronounced effect which is less noticeable, over the range investigated, when the same proportion of calcium is added as chloride. The higher concentration of potassium and sodium added as chloride shows a pronounced adverse effect which is not found with the highest concentration of potassium and sodium added as carbonate, possibly due to the high alkalinity in the latter cases.

From the results in Table No. 1 and 3 it seems probable that the compounds of certain alkaline earth metals (*e.g. calcium and magnesium*) in certain Estate waters could interfere with the lamination. Accordingly sample lots of Permutit ion exchange resins have been imported for partial demineralisation experiments. The resin used is called Zeo Karb 216 and contains weakly acidic carboxyl groups. This resin will exchange hydrogen ions for metal ions when the latter are associated in solution with the anions of weak acids.

$$2\,R\,COOH + Ca(HCO_3)_2 \quad (R\,CO_2)_2\,Ca + 2H_2O + 2CO_2 \quad -1$$

$$2\,R\,COOH + Ca\,SO_4 \quad \text{only a slight reaction} \quad -2$$

The resin is activated with about 1.85 bed volumes of 1% sulphuric acid and regeneration is carried out with the appropriate volume of 2 N hydrochloric acid. The makers of the resin specify that excessive acid should not be used in the regeneration of Zeo Karb 216 otherwise splitting of the salts of strong acids may take place in the sense of equation 2 above. The formation of appreciable amounts of strong acids in crepe milling waters is almost certainly undesirable. Small scale resin columns have been used to treat Warriapolla water for laboratory dipping tests. The results are included in Table No. 4, where the treated water which still contains most if not all of chloride and silica is found to be quite satisfactory in small scale tests.

Table No. 4 – Ion Exchange Treated Water etc.

Source of Water	Calcium Content	Quality of Lamination of Dried Laces	
		10 Mins. Soaking	Overnight Soaking
Dartonfield Mill Water	2 p.p.m.	Satisfactory	Satisfactory
Vykumbra, Passara	52 p.p.m.	Very Poor	Very Poor
Warriapolla, Matale	75 p.p.m.	Very Poor	Very Poor
Warriapolla Water passed over regenerated Zeo Karb 216	1 p.p.m.	Satisfactory	Satisfactory

In later tests, arranged with the co-operation of the present Superintendent at Warriapolla Estate, Matale, the columns of Zeo Karb 216 have been erected at Warriapolla factory and some 50 gallons of factory water treated. This water has been used on the last smooth mill of the sole crepe process and the Superintendent reported that the sample laces laminated (without a hot table) were more satisfactory than the standard samples.

4. Discussion.—While there is good reason to suppose that the dissolved solids in factory milling waters can be of importance vis á vis the quality and ease of lamination of sole crepe laces, further tests over a more prolonged period of time would be required to ensure that one pass on the last smooth mill using water passed over Zeo Karb 216 will overcome the necessity for using a hot table at Estates, such as Warriapolla. The reason for recommending prolonged tests is that the analysis of the original factory water and the quality of the lamination do not appear to be independent of the season. It seems unlikely that such tests will be carried out in Ceylon at present. Comparatively recent f.o.b. estimates of a plant capable of producing 2,000 gallons of the above 'treated' water before regeneration are of the order of over £ 1,000. In addition the cost of regeneration in terms of acid used may approach Rs. 15/–. While the actual cost of the plant selected depends upon the analysis, of the incoming water and upon the analysis required in the treated water, high cost plants and the relatively cheaper and conventional partial demineralisation systems which may be suitable seem at present neither attractive, due to the depressed crepe price, nor absolutely necessary, due to the comparatively recent successful adoption of latex bleaching techniques at some of the Estates concerned.

It is not inappropriate to point out that in the early stages of this work, that is before the introduction of R.P.A.3 at the Estates concerned, there was a distinct possibility that the cost of the ion exchange or other plants or of rain water storage units would be covered by the improvement in colour found, at least in some cases, as a result of avoiding the use of hot tables. Comparatively early in this work, the comment was made outside Ceylon that it seemed difficult to believe that small amounts of dissolved solids in factory waters could interfere in processing when much larger proportions of some of the constituents of the waters usually occur naturally in the latex and for this reason inter alia it seemed necessary to persue this subject in some detail.

5. Summary and Acknowledgment.— The experiments described in this paper show that the total solids present in the water used in small scale lace soaking experiments can have a marked effect on the ease and/or the quality of the lamination of dried sole crepe laces. Evidence is presented which strongly suggests that similar considerations may apply in commercial practice. It is questionable whether the apparent high cost of any suitable partial demineralisation plant, based on ion exchange resins, could at present be considered worthwhile in Ceylon, at least for the conditions familiar to the authors.

Acknowledgment is made to the Proprietors, Agents and Superintendents of the Estates, in particular of Warriapolla Estate, Matale, where the R.R.I.C. was permitted to carry out tests or select water samples.

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COVER CROPS OR WEEDS

(Which is which)

By

D. H. Constable, Agronomist

"Weeding" forms a considerable part of the budget of the present day Ceylon Rubber Plantation. Costs range from Rs. 25/– per acre per annum in good areas to Rs. 100/– or more in bad areas. Very rarely nowadays does one find an area in which the canopy consistently is acting as an effective weedkiller.

Considering the average price and yield of rubber it is evident that weeding forms from 5 to 20 per cent of an estate's outgoings and it seems worth while considering some aspects of the problem.

Speaking at second hand it appears that the original policy was one of rigorous clean weeding carried out with military thoroughness. Fortunately for the soil of Ceylon and the continued existence of the rubber industry the depression put an end to this and it became necessary to tolerate some degree of untidiness between the trees. To keep this at a minimum it was desirable to plant or grow one single plant instead of a catch-as-catch can mixture and presumably a creeping plant of satisfactory habits was sought. It was, I imagine, at this stage that the word "legume" crept in and some time between 1930 and the present date the essentiality of the legume has been established beyond (the planters) questioning. Similarly the existence of any other cover, generally referred to as, "chedis", is unsatisfactory and calls for "weeding".

Now before going on to discuss the nature of a legume it is convenient to attempt to define a weed. The usual definition is "a plant growing out of place". It can also be described as "any plant which, on the site considered, is far more hardy and fertile than the one wanted". You might also call it "the crop that is better suited to the soil than the crop you are trying to grow".

Next let us consider the nature of leguminous plants. These are generally described as nitrogen fixing plants but this is not strictly true. What is true is that they are capable of acting as hosts for certain bacterial species, which, in return for a home and a supply of carbohydrate food etc. will absorb nitrogen from the air and turn it into compounds which the plant can use. The bacteria live in the nodules which are formed when they invade the root tissue. The presence of nodules on roots indicates the presence of bacteria but nothing more. It is no proof or even favourable evidence for the fixation of nitrogen. The actual type of nodule and position on the roots can be used as rough indicators however. The conditions for nitrogen fixation are somewhat stringent and are listed here :

(1) Each leguminous species can only be infected by certain bacterial strains which vary between species and between genera.

(2) Not all strains are nitrogen fixing or usefully nitrogen fixing on any one species of legume.

(3) Useful strains may mutate into non effective strains or may be attacked (*by bacteriophages*) and converted into a non effective strains.

(4) The correct nutrient relationship must be maintained. Calcium, potassium, phosphate, boron and molybdenum are very necessary to the nitrogen fixing process. However the latter two in slight excess are very harmful and it is not possible to manure with either element without scientific advice and control.

(5) Soil Acidity is generally discouraging to bacterial activity and as a generalisation pH 5 is about the lowest limit for useful fixation.

(6) The use of fertiliser nitrogen generally slows down the fixation of nitrogen *i.e.* the process may only go full speed when there is insufficient soil (*combined*) nitrogen available.

(7) The nitrogen from legumes is not excreted in field practice, but only becomes released from the legume when part of the legume *e.g.* the roots or leaves die. It is then in heavy rainfall areas leached out in the same way as ammonium sulphate.

Having summarised the requirement for nitrogen fixing in legumes let us examine their normal use in temperate climates. Most farming nowadays is done on a "rotation" system allowing a certain number of years to mixed crops followed by a resting period. This resting period is frequently in pasture or "ley" which can be used for grazing or hay thereby avoiding a total loss on the field during the resting period. Now if a crop is to be grown and taken off the field during this resting period it must be manured or the land will be impoverished.

Nitrogen is almost invariably needed as a manure and is also the most expensive so it is desirable to use a crop with a low nitrogen requirement and this is where the legume, and particularly the pasture type of legume, is so valuable in addition to its high protein content as a fodder. The area is sown to suitable varieties of clover, and other pasture legumes properly inoculated with the correct bacterial strain, the necessary amount of phosphate and potash added, and the farmer can hope to get 1–3 years cropping (*grazing*) from the land without spending one penny on nitrogen. At the end of this time the pasture is ploughed in giving a heavy manuring of nitrogenous green matter for the use of the next crop. The proper management of such pastures is a matter of careful study. Scientific advice is sought as to the acidity and nutrient content of the soil, while generally, when the seed is purchased, a culture (*inoculation*) containing the correct bacteria for that species of legume, is purchased also and distributed with the seed by wetting the seed with it before sowing using a suitable sticker such as skim milk etc. One final point while on the subject of "leys" is, that their life is strictly limited by the phenomenon sometimes called "clover sickness", but which is common to most legumes (*except perhaps the leguminous trees*). This sickness is simply an inability of the land to support further growth of the legume until it has been rested for a number of years or thoroughly sterilised, a very difficult process on the large scale.

Now let us see how all this applies to our Ceylon Rubber problem. It will immediately be seen that there is practically no point of similarity. We have :—

(1) That the legume is not being grown to rest the soil between cash crops.

(2) That nitrogen has to be added as fertiliser to benefit the crop (*rubber*).

(3) That the soils under consideration are far more acid than would be considered suitable for raising an effective legume.

(4) That we have no knowledge of the bacterial status of the soil as applied to the legume and its effectiveness.

(5) That we are attempting to grow the same legume continuously on the same soil and to re-establish it immediately it fails.

I should perhaps mention that an ex-Malayan planter has told me that it used to be the practice that leguminous covers were slashed and dug under at 2–3 year intervals which does give an approach to a proper system of legume management. This practice seems however to have died out and been forgotten. In Ceylon it was often the practice to slash the covers and bury in the silt pits. This has also gone into discard.

So in fact, entirely the wrong attitude is being taken towards cover crops, largely, it is presumed, through a misunderstanding of the leguminous process and its agricultural application.

The result is, for example, the spending of large sums of money on the eradication of a successful creeper such as **Mikania scandens** and the further heavy expenditure on trying to replant, say, **Pueraria phaseoloides** on a soil which will no longer support it, possibly because of "sickness". Finally supposing one's efforts to be successful what has been achieved? Mainly a change over of a vigorously growing creeper forming a good soil mulch for a similar creeper of less vigorous habit with a very doubtful nitrogen fixation and a considerable expenditure on "weeding" it. Having worked hard on the young clearing in this manner the canopy closes and the Pueraria dies out probably having to be re-established at considerable further expense later when, due to Oidium or Phytophthora, the canopy becomes less dense allowing grass and "weeds" to start up again.

It should not be thought at this point that this article is written in praise of **Mikania scandens.** The intention is that all those responsible for rubber planting policy should stop and ask themselves "what positive advantage do I expect to get from weeding and what is the financial advantage". If the answer is that you are replacing X by exactly the same type of plant with a theoretical nitrogen fixing capacity then it might be much better for all concerned to leave X alone and spend the weeding money on manures. Sulphate of Ammonia costs about 20 cents per lb. so the average weeding vote would buy quite a lot of fertiliser and give less disturbance and erosion to the soil together with much more green manure to be slashed and mulched at intervals to the probable benefit of the rubber.

Woody perennial weeds are usually considered undesirable due to competition effects. Soft herbaceous covers are better for decomposition and to keep in control.

Grass, it must be admitted, is a different matter and though the writer would prefer grass to bare soil, because of the erosion question, there is not much doubt that the effect of grass is slightly adverse. This is probably due to the formation of a very thick "mat" which restricts aeration and may render

the soil "sour". At the same time it must be said that, as far as the writer knows there is no positive evidence for the adverse effect of grass on rubber and it is probable that the older the trees are, the less effect there is. Ferns or "kekilla" are unsatisfactory more because they indicate the poorest grade of soil rather than any intrinsically harmful qualities.

Finally the writer would like to enumerate some possible alternatives together with some of the Dutch findings on this matter (*see Hevea by Dijkman, University of Miami Press Fa. U.S.A., Chap.* 5). They comment that non legumes have been added because of their other valuable properties and because many tropical legumes are ecologically confined to very specific localities and show very conspicuously the phenomenon called "fatigue" (*Page* 29).

They suggest **Vigna hosei** but say that it dies out after three years.

Centrosema pubescens lasts 4-5 years and comes back after 1-2 years rest under other vegetation. This latter has been found to come back by self seeding after as long an absence as 15 years in the Matale District. It is not eaten by cattle. Its root competition is liable to have a slight adverse effect on young rubber. It will stand the deepest shade.

Calopogonium mucunoides is tolerant of poor soil and light shade and seeds easily.

Mimosa invisa or **pudica** is very hardy but the thorns are a nuisance. It is not eaten by cattle. It seeds well, dying out under shade but coming back through the dormant seeds as soon as the canopy lightens.

Eupatorium triplinerve, Salvia occidentalis and **Indigofera endecaphylla** are also recommended and used extensively in Indonesia.

In hedge planting and in contour dikes etc. a number of upright plants mostly of the type regarded here as weeds are used and slashed for green manures. Among these are **Ageratum mexicanum, Altenanthera amoena, Eupatorium, pallescens Lantana camara,** together with better known types like **Crotalaria, Tephrosia,** etc.

At this point it may be of interest to quote from the latest Dutch text books on Tropical Agriculture in Java as to the desirable qualities of a cover crop. I am indebted to my colleague Ir. J. H. van Emden for this translation from Van Hall, "de Landbouw in den Indischen Archipal" (ed. *Van Hoera — The Hague*), p. 118.

"In general the following are desirable characteristics for ground covers :

(1) Easy propagation, for preference by seed.
(2) A root system which holds the soil firmly, but does not require too much from the soil and does not compete with the main crop.
(3) Rapid growth and abundant leaf production in the open as well as under shade.
(4) Should stand up against regular slashing.
(5) Resistant to drought, pests and diseases.
(6) No characteristics troublesome to men, such as thorns or spikes.
(7) Easy eradication from the plantation if so desired".....
.....

(8) In rubber should be a low cover in wet areas so as not to impede air circulation and drying out of panels to avoid panel diseases and allow tapping.

"One uses for preference leguminous plants, as these by possession of root nodules leave the soil nitrogen unused and often add to same. Apart from leguminous plants the Indonesian planter also uses non-legumes because of their other not less valuable properties....."

You will note that leguminous properties do not figure in the original selection at all but only preferentially after the primary considerations are met.

In our Circular No. 25 shortly to be reissued with amendments there is a considerable list of potential cover crops and their characteristics to which any planter having difficulties would be well advised to refer. It is a very sound policy to have several cover crops tested for one's estate, so that as one species fails another dissimilar plant can be substituted with reasonable confidence.

In conclusion it may be mentioned that the chemical control of "weeds" is under active investigation. With the materials at present available commercially there is no probability of bringing costs below Rs. 25/– per acre per annum for susceptible species and Rs. 50/– or more for more hardy types. This type of control will only, at best, give a temporary eradication and it will still be necessary to put in a suitable cover crop directly the soil is clear enough. In this case it is important to have a satisfactory cover crop because if there is delay in cover establishment, the weed seeds will germinate and compete effectively with the cover crop thereby wasting the cost of the chemical treatment.

This article may then be summed up, as a plea to planters to abandon the attitude that **Desmodium ovalifolium** and **Pueraria phaseoloides** are the only covers and to consider and test out any other plants that will fulfil the requirements of a cover crop and that will require the minimum amount of establishment in the area in which they are to be used.

WHERE ARE YOU GOING, NATURAL RUBBER?*

On May 6th Dr. R. Houwink, Director-General of the Rubber Stitching, Delft Holland, addressed the Ceylonese rubber interests at a large meeting, held under the auspices of the Low-Country Products Association. The Speaker was introduced by Mr. S. Pathmanathan, Chairman of the Low-Country Products Association, who stressed the great importance of Rubber for Ceylon's economy.

Dr. Houwink started to quote from well-known economical studies that, although the world consumption of rubber as a whole may be expected to increase very substantially in the future, it is an open question which part of it will consist of natural rubber. This will depend on the cost price and on the further development of its technical qualities in competition to synthetic rubber and plastics.

**The Rubber Research Institute of Ceylon welcomes papers on subjects of general interest from outside contributors but does not accept any responsibility for the views expressed therein.*

WHAT CAN THE NATURAL RUBBER PRODUCERS DO TO MAINTAIN OR TO IMPROVE THEIR POSITION ?

Regarding the price one of the best answers to give can be found in the replanting scheme of Ceylon with higher producing clones. It will depend on the cost of labour whether this will make economic competition with synthetic possible in the long run, but considering the producing capacity of modern high yielding clones, there are promising outlooks here.

Regarding the technical development Dr. Houwink made a sharp distinction between properties (like stability or processibility of latex and vulcanisation speed) which are connected with the so called non-rubber constituents and the properties which are connected with the pure-rubber itself.

In both fields a lot of work can still be done for improving the position for natural rubber. The introduction of technically classified rubber emerges from the idea of controlling the amount and the sort of non-rubber constituents leading to rubbers which are uniform in vulcanising characteristics. This product is now being produced in Indo-China, Malaya and Indonesia in a quantity of about 80,000 tons per annum and it is expected to increase rapidly further.

A very important step ahead for the smallholder is that now the dirt content of lower grades can be determined exactly according to methods developed in Indonesia. This will furnish the basis for a better system of grading so that in future the price will correspond to the real intrinsic properties (which are excellent for most lower grades). This system will break with the existing system of grading according to colour, etc. and will bring a great part of the lower grades on a higher and justified price level.

Coming to the properties connected with the pure rubber itself, the speaker stressed that due to intense research work quite a number of new developments are already coming into the practical stage, where competition with synthetics is possible. An example is the footwear market where a shift to harder materials than used hitherto is taking place since such materials became available from the synthetic side. Time will come very soon that this need can also be fulfilled by natural rubber due to new improvements in the so-called cyclising processes which convert natural rubber also into such a hard material.

Completely new lines can be followed by the production of rubber derivatives leading to a wide scale of new materials which may enter into competition with synthetic rubber and plastics or which may open promising new fields for themselves.

Apart from these completely new lines a more conventional way of finding new outlets is by applying latex or rubber as such but with fresh ideas in the background. Important fields as rubberised roads, cheap floorings, wall coverings, textile applications, etc. are still open here and have to be pursued vigorously.

Reconsidering the whole situation Dr. Houwink came to the conclusion that the chemical structure of natural rubber being fundamentally sound, it still holds a prominent place between its competitors — synthetic rubbers and plastics.

He considered three elements as essential for a sound future of natural rubber : these are — (*a*) a competitive cost price, (*b*) a sound scientific and technical development by all the producers together in order to explore new markets, (*c*) the availability in time of sufficient trees to fulfil increasing demands.

If the latter factor would be neglected the synthetic industry, which can expand its capacity very rapidly, would take away all results reached by the natural rubber producers because no consumer is willing to wait eight years for the materials he needs.

Therefore, what we need is : replanting in order to reduce the price and that on a scale which takes into account future rises in consumption. This combined with vigorous technical developments in order to keep abreast with synthetic rubber and plastics.

REPLANTING OF RUBBER SMALLHOLDINGS UNDER THE SUBSIDY SCHEME

By

W. I. Pieris, Smallholdings Propaganda Officer

Introduction

This leaflet briefly explains how best a smallholder should replant his Rubber to obtain the Rubber Replanting Subsidy.

The average smallholders' Rubber today seldom yields over 300 lbs. per acre per year. The best new clones give 1000 lbs. or more. If the old rubber, therefore, is replanted on correct lines and given proper attention and manure, there is no reason why a smallholder cannot earn at least three times as much from the same plantation.

There are 650,500 acres of Rubber in Ceylon of which 48% consist of smallholdings (1-10 acres) and small estates (10-100 acres). Small owners, therefore, owe a debt to the country to replant and improve their lands and the subsidy enables them to do so at the country's expense. No such opportunity may occur again.

Permit

Obtain a replanting subsidy permit from the Rubber Controller *before* any work is started. Apply for permits on the special forms obtainable from the Rubber Controller. Rubber Instructors will help in filling forms if necessary.

Uprooting and Clearing

Uproot trees preferably in January/February to enable burning and clearing in dry weather in February/March. To remove diseased roots that may infect the new Rubber, dig round the trees to cut the main lateral roots and have them pushed over. Burn all diseased roots which the Rubber Instructors will help you to identify. Sell the timber for firewood or, if unable to sell it, burn the leaves and twigs and leave the logs horizontally across slope of hill to check erosion.

Inform the Rubber Controller after uprooting and clearing and a Visiting Agent will visit the land to approve payment of the first instalment of the subsidy.

Lining for Holes

Call in the nearest Rubber Instructor to line the land for holes which should be on the contour on sloping land. He will line it and also give other necessary advice free of charge. If the address of the Rubber Instructor is not known, write to the Smallholdings Propaganda Officer, P.O. Box 901, Colombo and enquire. Rubber Instructors will do the entire lining on holdings whose acreage is under 10 acres and give a demonstration in lining on small estates of 10-25 acres.

At least 180 *holes per acre* must be planted for budded stumps or Tj. 1 selfed clonal seedlings. To do this, it is recommended that holes should be spaced 8ft. x 30ft., the wider spacing being between rows. Where square planting is preferred, holes spaced 12ft. x 20ft. would also give 180 plants per acre.

For mixed clonal seedlings at least 250 *holes per acre* are necessary and to get this, holes should be spaced 5ft. x 35ft. A high stand per acre is essential in this case to allow for subsequent removal of poor growers and bad yielders, which will leave a final stand of 140-150 high-yielding trees.

Unless the above initial stands per acre are planted, the subsidy will not be paid.

Filling Holes

Holes must be at least 2ft. x 2ft. with a depth of 2ft. at the centre. Fill holes with good top soil only. Mix half a basket of wood-ash (from the burnt rubber twigs and foliage) 6-8 ozs. of Saphos phosphate and one basket of decomposed cattle or compost manure with the soil in the upper half of each hole. Break bottom of the hole well with alavango before filling. The proper filling of holes is very important for the successful growth of the plants.

Soil Conservation

Adequate measures against soil erosion are essential on sloping land and should be provided immediately after the land is cleared. Contour drains between every two contour rows of plants are recommended and Rubber Instructors will help in lining them. A drain should be 2 ft. wide by 1½ ft. deep with uncut blocks of earth 2 ft. long at intervals of 15 ft. Earth from drains is heaped on the lower side in a continuous ridge. Where stones are plentiful contour stone terraces can replace drains.

No new drains are necessary where the old drains are serviceable. If not serviceable, they can be renovated to required dimensions. Where old drains are utilised, it does not matter if they are not exactly between the contour plant rows. If the number of old drains on the land is inadequate, cut extra new drains as advised by the Rubber Instructor.

Nethi-kanus or main drains should be provided down the natural folds of the hill to carry away excess water from the contour drains. They should not be deeper than 1 ft.

Fencing

Fence suitably against damage from cattle and wild animals. Barbed-wire fencing is best. A saving can be made by using rubber branches for posts but they will not last long and live *Gliricidia* stakes or arecanut trees should be planted in between, to replace them when they decay.

Planting

Plant only *approved* budded rubber or clonal seedlings. Large nurseries for supplying approved plants to small owners have been planted by Government. Plants from these nurseries will only be available to owners of lands of under 100 acres.

Apply to the Rubber Controller for plants well in advance. Clonal seedlings from Government nurseries will be available from May/June 1954 but budded stumps are not likely to be ready till 1955. Cost of plants supplied will be deducted from the subsidy.

Only those smallholders and small estate owners who apply to the Rubber Controller for plants and fail to get them, need book planting material from other registered nurseries or arrange to plant their own nurseries. A list of

approved sources of clonal seed is obtainable from the Rubber Instructor, Those who decide to plant their own nurseries should consult the Rubber Instructor well in advance and follow his advice. A permit must be obtained from the Rubber Controller for planting a nursery. Nursery permits to smallholders will only be allowed for providing their own requirements of planting material and not for purposes of sale.

Planting ordinary seed in holes and budding in the field later is not allowed under the Replanting Scheme. Those planting clonal seeds direct in the holes are required to plant not less than 3 seeds per hole.

Among budded clones, PB. 86 has so far given the best all-round yields in Ceylon and also possesses other good secondary characteristics. PR. 107, AV. 255, RRI. 501 and other clones approved by the Rubber Research Institute may also be planted. LCB. 870 is not a very high yielder, but it is resistant to oidium and is recommended for elevations of over 800 ft. It can also be used for crown-budding on other budded plants or clonal seedlings in oidium areas.

For those who prefer clonal seedlings to budded rubber, Tj. 1 selfed seed is recommended. When planted under proper conditions they have given yields almost as good as the best budded rubber.

Approved mixed clonal seed, while not up to the standard of Tj. 1 selfed seed, is capable of giving substantially high yields, *provided* not less than 250 plants per acre are planted for subsequent thinning. Those planting mixed clonal seedlings must be agreeable to thinning out their stand, to a final stand of 140–150 trees, in gradual stages as advised by Rubber Instructors.

Do all planting in wet weather, preferably during the South West monsoon in May/June. Damage the roots, especially the small lateral roots, as little as possible but if unavoidably damaged, cut them off clean. Compress the earth tightly round plants after planting. Place a basket or split bamboo in front of bud to make bud-shoot grow up straight and to protect it. It is wise to have some extra plants elsewhere to replace vacancies later.

The bud should normally shoot in 1-3 months but all other stock shoots must be removed. Do not allow branching of the bud-shoot to a height of 6 ft.

All planting must be completed within one year of the payment of the first instalment.

Notify Rubber Controller for the second instalment of subsidy after completing planting.

Cover Crops

Plant a mixed ground cover during the first wet weather after clearing. It is of great value in improving the fertility of the soil and in checking erosion. *Pueraria, Centrosema, Vigna* and *Calopogonium* are good creeping covers. *Crotalaria Tephrosia* (*Boga*) and *Desmodium ovalifolium* are suitable erect covers. The latter should be planted on the contour. Keep a radius of 4 ft. round rubber plants clear of all cover crops.

Grass or cattle-grazing must not be allowed on any condition.

Interplanting with other crops is not permissible under the Replanting Scheme.

Manure

It is essential that plants should be regularly manured if satisfactory growth is to be obtained. Payment of the third, fourth and fifth subsidy instalments will depend on the satisfactory growth of the plants. Subject to this, the 3rd instalment will be paid one year after the conpletion of planting, the 4th instalment one year after the 3rd instalment and the 5th one year after the 4th.

R 465 manure mixture is recommended. Give 1 lb. per tree in first year, 2 lbs. in 2-4th years. 3 lbs. in 5-7th years and 4lbs. thereafter. Add this in 3 or 4 small doses during the year rather than in a single large dose.

Cattle or compost manure is excellent if available. About 100 lbs. per tree per year are needed. For every 25 lbs. of cattle manure, the above dose of artificial manure can be reduced by $\frac{1}{4}$. Rubber Instructors will instruct on a simple method of preparing compost.

Minimum Requirements

The required minimum growth standards for obtaining the later grants are :—

	Circumference at 3 ft. above ground.	
	Where Annual Rainfall Over 100".	*Where Annual Rainfal-Below* 100".
At the end of 2nd year	4"	4"
At the end of 3rd year	$6\frac{1}{4}$"	$5\frac{1}{2}$"
At the end of 4th year	$8\frac{1}{2}$"	$7\frac{7}{8}$"
At the end of 5th year	11"	$9\frac{1}{2}$"

The required minimum stand per acre for all budded stumps and Tj. 1 selfed clonal seedlings is :—

Initially	180 trees per acre
At end of 1st year	150 trees per acre
At end of 2nd-5th years	140 trees per acre

The required minimum stand for all other clonal seedlings is :

Initially	250 trees per acre
At end of 1st and 2nd years ...	200 trees per acre
At end of 3rd year	180 trees per acre
At end of 4th year	160 trees per acre
At end of 5th year	150 trees per acre

In addition to the land being generally well maintained, soil conserved etc., the above requirements will be insisted on. To avoid unnecessary disappointment, owners should manure and care for their plantations properly right from the beginning. Plants which receive an early set-back are difficult to repair. If the instructions in these notes are followed, there should be little cause for worry.

Tapping

Do *not* commence tapping these valuable replanted holdings until the trees have attained a girth of 21" at 3 ft. above ground level. Whatever the material planted, do *not* tap more often than a $\frac{1}{2}$ spiral cut every other day.

NOTES ON THE INCIDENCE AND CONTROL OF OIDIUM HEVEAE IN CEYLON

By

Ir. J. H. Van Emden, Mycologist

1. Incidence
1.1. Environment
1.2. Clonal susceptibility
1.3. Manuring

2. Control
2.1. Indirect control
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1. INCIDENCE OF OIDIUM HEVEAE IN CEYLON

1.1. Environment

Oidium can occur with disastrous effects in all rubber growing districts of Ceylon and is not limited to the higher elevations. The difference between higher and lower elevations is, that in the former Oidium may be found throughout the year, while in the latter the fungus is usually inconspicuous except during the refoliation period after wintering.

Mildew is also more difficult to control at higher elevations and due to its continuous attacks on young leaves, the long term effect on the trees is much more serious. A further difference is, that many clones, which show a reasonable degree of resistance to Oidium in the low country, do not show this favourable characteristic at the higher elevations or do so to a much lesser degree. For instance, clone PB86, which is hardly ever seriously affected in the low country, may suffer considerably at higher elevations. Even LCB 870 which is highly resistant at the altitudes where rubber is normally grown, may be badly attacked above 2000 ft.

It is not known what conditions are responsible for the epidemic occurrence of Oidium. The fact that, during the period of refoliation of the rubber plantations after wintering, the abundance of susceptible material leads to a high concentration of inoculum in the air, is at least partly responsible for the omnipresence of Oidium towards the latter part of the refoliation season, but the sudden increase in severity, which can often be observed, suggests that some change in the weather brings about the combination of conditions needed for epidemic occurrence of Mildew.

There are indications, that a dry refoliation period makes for a light oidium-season, while a wet refoliation period is favourable for a more severe occurrence of Mildew. Whether this is due to the high relative humidity, or to the fewer hours of sunshine or to the removal of sulphur dust from the leaves by rain showers is not known. Oidium diseases are generally considered to be worst in the dry weather, but in the literature on powdery mildews

records may be found of observations which support the view, that a high relative humidity, possibly combined with a favourable temperature furthers the occurrence of powdery mildews on crops and also favours germination of spores in vitro.
(*LAST, NILSSON, NISHIKADO*).

1.2. Clonal Susceptibility.

After the 1953 season an analysis was made of the reports on the incidence of Oidium according to clones and it was found, that the differences were considerable. Because the reports of the 1954 season have not yet come in, a complete picture of the position in 1954 cannot yet be given, but from the available data it appears that last year's observations will be confirmed. If sufficient data become available for a number of years, a fairly accurate picture will be obtained of the susceptibility of all clones in general use. Tj. 1 was badly affected in 1954 and appears to be even more prone to Oidium than BD. 5; possibly because it combines susceptibility with the habit of late wintering, whereas BD. 5 is one of the earliest winterers. The slow recovery of this clone however greatly offsets the advantage of the early start. PB. 86, PR. 107 and HC. 28 escaped lightly in 1954 and several favourable reports of MK 3/2 were received.

With regard to LCB. 870 it can be reported that this clone remained free from Oidium at Kepitigalla Estate at 1580 ft. without application of sulphur. Hence although LCB. 870 may be severely affected by Oidium at 2000 ft. as was reported above, it again proved its resistance for the normal rubber-producing area.

1.3. Manuring

There is no experimental evidence with regard to the influence of manuring on the susceptibility of Hevea for powdery mildew. Experience with other crops however indicates, that manuring with nitrogen brings about an increased sensitivity to the disease. Last states, that after nitrogen manuring of wheat a period of increased sensitivity occurs, which however passes away.

HOPFENGART found, that particularly nitrates (as opposed to ammonium salts) increased the sensitivity of barley, while potassium manuring resulted in a decreased sensitivity.

TAPKE, also working on barley, states, that conditions making for succulent growth, such as subdued light, plenty of moisture and liberal nitrogen make for susceptible plants.

The above should not discourage anyone from manuring his rubber, because manuring influences in the first place, growth, bark renewal and probably yield. Besides, given a clone of average susceptibility and normal growing conditions, the available method of direct control should be sufficient to prevent Oidium-damage. The above is however of importance to those who think, that manuring can take the place of sulphur-dusting. From the above it is quite clear, that this cannot be the case. The practice of giving large quantities of nitrogen immediately before the wintering season, which is found on a few estates, must be considered a dangerous procedure. It should be understood that unless there are plenty of leaves on a tree, there is very little to be gained from heavy manuring. On the other hand, if the trees carry good foliage, they are in an excellent position to utilize

the available mineral nutrients. **If an estate finds itself in the position, that it is financially impossible to control Oidium and to manure over the entire area, it should not choose between either sulphur-dusting or manuring, but it should carry out both operations on the most valuable fields, as far as funds permit.**

2. CONTROL OF OIDIUM

2.1. INDIRECT CONTROL

The cheapest way of controlling Oidium is by growing resistant varieties, provided they are on the same level of productivity as the average modern planting material.

For the time being we have no such varieties and although a few thousand cross pollinations of LCB 870 are available at the Institute for selection, the chances that a new clone answering the requirements for resistance and productivity will be shortly available are rather remote.

An alternative to growing a resistant clone is crown-budding existing high yielding clones with a resistant crown.

The cost of crownbudding is rather high, but could be reduced (a) by adopting a system of hedge or avenue planting and (b) by reducing the height of crown budding from 8 to 6 ft. This latter step would not only reduce the cost of the operation itself, but would also make it possible to carry out the operation at a younger stage, thus saving time and consequently also money. It should however be emphasized, that reducing the height of crown-budding may have an unfavourable influence on production and until more is known about the influence of the crown on the production of the centre section, it is not advisable to deviate from the recommended height of 8 ft. The matter is however mentioned here because of the advantages which would result if crownbudding at six feet instead of at 8 feet could be permitted.

While dealing with the matter of crown-budding it should be pointed out, that in those countries where *Dothidella ulei*, the South American Leaf Blight is prevalent, crown-budding is a necessity, if any rubber is to be grown at all (until resistant hybrids become available). Since rubber plants, low yielding, but resistant to S.A.L.B. and hence suitable for crownbudding only, will become available to the R.R.I. very soon ,the use of this material in preference to LCB 870 deserves serious consideration with a view to the possibility that the South American Leaf Blight may enter the country at any time.

The system of hedge or avenue planting mentioned above deserves to be considered by everybody interested in the control of Oidium, not only because cost of crown-budding would be reduced, but also because application of fungicides, especially of sprays, would be greatly facilitated . Also we can expect, that the spacing of trees according to the hedge planting system will make conditions for Oidium less favourable by allowing better circulation of air and hence a quicker drop in the relative humidity of the air in the field.

It should be said here, that hedge planting has been practised now for a number of years on an experimental scale, both in Indonesia and in Malaya and that no adverse effects on yield have been discovered. True enough not all clones are suitable for this system of planting. Clones with a leaning habit such as for instance Tj. 16, lean badly when spaced closely in the

row, but there are a number of clones which show no undesirable characteristics if grown in hedges. The pictures published by Schweizer in the "Archief voor de Rubbercultuur 1951" illustrate these differences very well.

2.2. Direct Control

2.2.1. Dusting

At the end of the 1953 Oidium season the conclusion was reached that dusting according to standard recommendations *i.e. five rounds of twelve pounds of sulphur per acre at one week's interval*) gave a satisfactory control of Oidium on average clones and under average circumstances, but was insufficient if the more sensitive clones were concerned or if conditions were unfavourable. This conclusion was confirmed during the 1954 season. It was again found, that if the incidence of Oidium was naturally light, dusting according to standard recommendations gave good protection. If however the attack was severe the protection was insufficient.

In an experiment in which the falling leaves were caught on sample areas of 9 sq. ft., it was found, that dusting once a week at a rate of 12 lbs/acre reduced the leaf fall to 50% of what it was in the untreated area. Dusting twice a week at the same rate reduced the leaf fall to 30% as compared to the control.

It was attempted to increase the efficiency of dusting by (a) incorporating a dust sticker in the sulphur, (b) by using so called redispersible sulphur. The use of the sticker did not bring about a noticeable improvement. Since this substance was admixed locally, its distribution may have been poor and it is recommended that sulphur powders with machine-mixed stickers be tried in future. Redispersible-sulphur powders are really wettable-sulphur powders made into a form in which they can be applied as a dust. The idea is, that the sulphur caught on the leaves will go into suspension as soon as the leaves get wet by dew or otherwise, thus producing an effect similar to that obtained with a spray. This redispersible sulphur has now been tried for two years in succession and the result has been disappointing. As the idea appears sound enough it is expected that the manufacturers will try to improve on their present product and redispersible sulphur powders should be kept in mind for future experiments.

A future improvement in dusts may be obtained by addition of another fungicide to the sulphur dust. This possibility will be discussed below under 2.3.

2.2.2. Spraying

In 1953 it was found, that spraying with either wettable sulphur at 4 lbs. acre/week or with lime sulphur at 1½ gall./acre/week gave practically complete protection on the trees which were actually sprayed. In order to reach all trees it was necessary with the then available machine (Micronsprayer) to take it along every second row. It was hoped, that if more powerful machines would become available a much greater depth of treatment could be achieved so that a swath-width of about 100 ft. could be obtained.

In 1954 two large mistsprayers were available to the Institute, one was Messrs. Drake and Fletcher's "Mistejecta" and the other Messrs. Birchmeier's "Biatom III"

In this season it was again found, that the trees actually reached by the spray remained virtually free from Oidium, but it was also found, that the depth of treatment (range) even of these big machines was not more than between 60 and 70 ft. Also it was found, that in order to obtain the necessary range and a sufficiently dense coverage, the forward speed of the machine should not exceed 1 m.p.h. This .limits the capacity of the large machines mentioned above to 8 acres per hour (in ordinary square planted rubber). Hence although spraying again proved its efficacy as a method of Oidium control, the application difficulties appear to be even greater than was anticipated.

2.2.3. Comparison between dusting and spraying

2.2.3.1. The Control aspect.

Dusting and spraying were compared in two field experiments.

(a) **Experiment on Clone BD. 5.**—About 24 acres of BD. 5 were divided in twelve plots of two acres each (tapping tasks).

Of these twelve plots six were sprayed (two kinds of spray, each replicated three times) three were dusted and three were left untreated.

In this field Oidium was very light and the leaf fall was negligible. Hence no leaf counts could be taken and Oidium had to be assessed by classing a number of sample leaves according to the amount of Oidium spotting on them.

Samples were taken by collecting the lowest stem shoot of every fifth tree except from the two border rows on all sides.

As in the previous year, when this field underwent a similar treatment five classes of spotting were distinguished :—

(1) No spots
(2) Very few spots
(3) Few spots
(4) Many spots
(5) Leaves incomplete through loss of one or more leaflets.

It is considered that only leaves in classes (4) and (5) were seriously impaired in their physiological activity.

The assessment showed the following result :—

Class	Spray treatment (1)	Spray treatment (2)	Dusting	Control
(1)	2	—	—	—
(2)	28	26	19	12
(3)	33	38	20	25
(4)	37	36	61	63
(5)	—	—	—	—

The above figures, although showing the superiority of the spray do not do justice to the treatments as they do not express the difference in appearance of the foliage which may be observed on the spot. Unfortunately there is not an objective means of expressing differences in appearance.

(b) **Experiment on clone Tj. 1.**—This experiment consisted of 24 plots of about two acres each.

Treatments :—

(1) No treatment
(2) Dusting with yellow sulphur no duststicker added, 12 lbs./acre/week
(3) Dusting with yellow sulphur with duststicker added 12 lbs./acre/week
(4) Dusting with yellow sulphur, no sticker, 12 lbs./acre twice a week
(5) Spraying with 6 lbs. Thiovit in 6 gallons of water per acre per week
(6) Spraying with 6 lbs. Aasulfa in 6 gall. water per acre per week
(7) Spraying with 6 lbs. Colsul in 6 gall. water per acre per week
(8) Spraying with 3 lbs. Aasulfa and ¾ gall. lime sulphur made up with water to make 6 gallons per acre per week

In this experiment there was a heavy Oidium attack and practically all the leaves in the control plots came off.

The experiment was assessed by collecting the falling leaves on trays of nine square feet, put out at a rate of three trays per plot at a few days interval from the beginning of leaf fall. see p 23

If the number of leaves collected in the untreated area is put at 100, the leaf fall in the other treatments was as follows :—

Treatment	Leaffall
(1)	100
(2)	51
(3)	48
(4)	30
(5)	24
(6)	23
(7)	17
(8)	12

From the above figures the following conclusions may be drawn. The control achieved by dusting twice a week is of the same order as the control achieved with the two wettable sulphurs (Thiovit and Aasulfa). The mixture of Lime sulphur and wettable su.lphur seems to be more effective than wettable sulphur alone. The colloidal sulphur paste "Colsul" appears to be somewhere between the wettable sulphur and the mixture of lime sulphur and wettable sulphur.

2.2.3.2. The aspect of cost

The cost of dusting is well enough known from experience and may be estimated at Rs. 4/– per acre per round if the price of sulphur is Rs. 0.25/ lb. and the rate of application is 12 lbs./acre. If we estimate the depth of treatment at about 100 ft. and the forward speed of the machine at about 1½ m.p.h. the area treated in 1 hour will be about 20 acres. If we assume two hours of actual dusting in a day the area covered in one day will be 40 acres. If we reckon with 6 days dusting a week one machine could cope with 240 acres if all rubber wintered simultaneously. Since, however, there are always early winterers and late winterers it will not be necessary to have a dusting machine for every 240 acres, but one machine will probably be capable of serving 300 or 350 acres, (if dusting is to be done on weekly rounds only.) If part of

the plantation will need dusting twice a week as is very likely number the of machines will have to be increased accordingly.

The cost of spraying is not known from experience and can only be estimated. The experience gained by the R.R.I. as to the capacity of a spraying machine combined with data available from disease control on tree crops in Europe afford a basis to arrive at an estimate for the cost of spraying if this were to be done in Ceylon on an Estate scale. According to figures quoted from the Dutch Year book of Horticulture (Tuinbouwgids 1953) the cost of spraying in orchards is as follows, expressed in Rs. per acre per round.

	Farm of 12.5 acres		Farm of 20 acres	
	If high-volume sprayer is used	If small mist-sprayer is used	If small mist-sprayer is used	If large mist-sprayeris used
Depreciation and interest	4.50	9.00	5.60	9.40
Maintenance and repair	1.10	1.10	0.68	1.10
Use of tractor	3.00	1.50	1.50	0.95
Fuel, tractor and sprayer	3.60	2.00	1.40	1.50
Chemicals	17.50	12.00	12.00	12.00
Labour	5.00	2.50	2.50	1.55
	34.70	28.10	23.68	26.50

From these figures we see, that a farm of 12.5 acres is considered large enough to purchase a high volume sprayer or a small mistsprayer for its own use. Apparently a large mistsprayer is considered justifiable if the size of the farm is 20 acres. The price of a small mistsprayer is given as Rs. 6,000/–; the price of a large mistsprayer as Rs. 9,500.

The capacity of the small mistsprayer is given as 1¼ acre/hour and of the large mistsprayer as 2 acres per hour.

Both machines are written off in five years time, because it is expected that the machinery will have become obsolete in that time.

The number of spray applications is ten per year.

This means that the large sprayer is written off after 500 hours of spraying and the small sprayer after 800 hours on the large farm and on the small farm after 500 hours.

How would these figures work out for Ceylon?

The cost of the type of sprayer used in the R.R.I.'s experiments is estimated at Rs. 10,000. The capacity is 8 acres per hour. If night spraying is done as well as day spraying, the capacity for the machine may be estimated at 50 acres per day. If weekly rounds are to be done and we estimate 6 days of spraying in a week, the machine could cope with 300 acres. If we assume that 5 rounds of spraying have to be done the machine would spray 1,500 acres an year in 250 hours of spraying. If the machine is written off in 1,000 hours, depreciation will be approximately Rs. 2.25 per acre.

For cost of maintenance and repair we may safely retain the European figure, because although these costs will undoubtedly be higher in Ceylon than they are in Europe if considered per hour, the greater capacity in Ceylon 8 acres/hour as compared to 2 acres/hour offsets this difference. The same is true for the items "use of tractor" and "costs of fuel". The item "chemicals" will be Rs. 6.00 (i. e. 6 lb. s. Wettable S at Re. 1 per lb.) The cost of labour may be estimated at Rs. 0.50/acre, i. e. two sktlled men Rs. 7.50 per day and four labourers at 2.50 per day for 50 acres. The total amount will then be made up as follows :—

Depreciation and interest	Rs.	2.25
Maintenance and repair	,,	1.10
Use of tractor	,,	0.95
Fuel	,,	1.50
Chemicals	,,	6.00
Labour	,,	0.50
	Rs.	12.30 /acre/round

To this amount has to be added the cost of putting in the necessary roads. On easy land these roads can be made at a cost of Rs. 2.50 per chain as was done at the R.R.I. Estate Nivitigalakele.

It follows, however, that even after the roads have been paid for, one round of spraying is three times as expensive as one round of dusting. Hence spraying is not economical on all rubber where Oidium can be controlled by dusting once a week.

Even if two or three rounds a week are necessary spraying will still be more expensive.

This means, that unless an entirely different type of sprayer becomes available, which would be cheaper to operate, there is no purpose in considering spraying for the average rubber estate. Spraying may be considered on estates where due to elevation dusting is not effective or in estates planted in hedges or avenues, where spraying would be cheaper than in the case of normal square or rectangular planting.

2.3. New and Promising Fungicide

For the first time since the discovery of sulphur as a fungicide against powdery mildews a new chemical has been developed of which it is claimed that it is especially effective against the Oidium fungi. The name of the new

chemical is "dinitrocaprylphenylcrotonate" ; it is also known under the trade names "Mildex" and "Karathane". Experimental quantities were obtained from the U.S.A. and the initial experiments, using the substance as a spray as well as mixed with dusting sulphur have been encouraging. Experiments will be carried out on a larger scale in the July-August refoliation season in the Moneragala area. The necessary quantity of the chemical will be imported by one of the Colombo firms, who are agents for this fungicide. If the experiments referred to, prove successful larger quantities will probably be available for more experiments in the next wintering season.

Recommendation

Resulting from the present knowledge the R.R.I. Ceylon recommends for the next refoliation season that commercial estates should provide for :

(a) One round of dusting with sulphur per week at 12 lbs. per acre in the case of light attacks of Oidium.

(b) Two rounds per week at 12 lbs. per acre round in the case of heavier attacks.

(c) One machine per 300–350 acres in case of (a).

(d) Two machine per 300–350 acres in case of (b).

(e) As the occurrence of (a) and (b) cannot be predicated a safe estimate, to provide for 50% of the dusted area to be dusted twice a week and and the rest once a week would be to provide 1 machine for each 250 acres and sufficient sulphur to dust at say 1½ times the normal rate of 12 lb. per acre for each of 5 to 6 rounds.

Acknowledgment

The Institute is geatly indebted to Companies, Superintendents, and Assistant Superintendents of estates who have made the various field experiments possible by their co-operation.

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RUBBER RESEARCH INSTITUTE OF CEYLON

Minutes of the 121st meeting of the Rubber Research Board held at the Planters' Association Head Quarters, Colombo, at 2.30 p.m. on Monday 6th July 1953.

Present.—Mr. W. P. H. Dias J.P. (*in the chair*), Mr. G. H. Dulling, Mr. W. Herbert de Silva, Mr. R. J. Hartley, Gate Muhandiram Arthur D. S. Jayasinghe, Mr. L. J. de S. Seneviratne C.C.S., (*Deputy Secretary to the Treasury*), Ir. J. H. Van Emden (*Acting Director*) and Mr. C. D. de Fonseka (*Administrative Secretary*).

An apology for absence was received from Dr. A.W.R. Joachim (*Director of Agriculture*).

1. Minutes.

(**a**) **Confirmation.**—Draft minutes of the meeting held on 18th May 1953, which had been circulated to members, were confirmed and signed by the Chairman.

(**b**) **Matters arising from the minutes.**—The terms of assistance to be given by the Smallholdings Dept. to replanters under the Rehabilitation Scheme were considered and defined. The preparation of a publication giving practical information regarding the replanting of rubber was also authorised.

2. Reports and Accounts.

Statement of Receipts and Payments for the Quarter ended 31st March 1953 was approved.

3. Staff.

(**a**) Changes in staff since the last meeting were reported.

(**b**) **Holiday on 2nd June.**—It was reported that 2nd June had been declared a holiday for the staff and labourers (with pay for the latter) on account of the coronation of Her Majesty Queen Elizabeth II.

4. Estate and Smallholdings Dept. items.

(**a**) **Tenders for buildings.**—It was reported that eight tenders had been received for the construction of an Asst. Staff bungalow and extension of Administrative block and Botanical Laboratories and that these had been circulated to the Experimental Committee for consideration. An award was made in accordance with the majority recommendation of the Committee.

(**b**) **Latex Centres.**—Correspondence regarding the prices offered by the Latex Corporation, Kalutara, for latex to be purchased from latex centres from August to December 1953 was considered and it was agreed that the Board could not interfere in the matter.

5. Control of Oidium by Aerial Spraying.—Arrangements being made by a certain firm for a large scale trial of aerial spraying by liquid fungicides in collaboration with the Research Institute were reported. The Institute's participation in the trial was approved.

6. Publications.

(**a**) **Cost.**—In view of increased printing costs since the present prices of publications were fixed it was agreed that publications should be sold at the following prices in future :

Annual Reports	...	Rs. 2/– per copy
Quarterly Circulars	...	Rs. 1/25 per copy
Advisory Circulars	...	–/30 cts. per copy

(**b**) Advisory Circular No. 36 was tabled.

7. Rubber Conference.—Reported that arrangements were being made for holding a Rubber Conference in Colombo on 16th November 1953.

Mr. Hartley left the meeting at this stage.

8. Bank Account.—Agreed that the Institute's main bank account be transferred to the Bank of Ceylon, Colombo.

The meeting then terminated.

Dartonfield,
Agalawatta.
23/7/53.

(*Sgd.*) C. D. de Fonseka,
Administrative Secretary

RUBBER RESEARCH INSTITUTE OF CEYLON

Draft minutes of the 123rd meeting of the Rubber Research Board held at the Planters' Association Headquarters, Colombo, at 2.30 p.m. on Monday, 26th October, 1953.

Present.—Mr. W. P. H. Dias, J.P. (*in the Chair*), Mr. W. Herbert de Silva, Mr. G. H. Dulling, Mr. R. J. Hartley, Dr. A. W. R. Joachim (*Director of Agriculture*), Gate Muhandiram Arthur D. S. Jayasinghe, Mr. L. J. de S. Seneviratne (*Deputy Secretary to the Treasury*), Senator C. F. W. Wickremasinghe, Dr. H. E. Young (*Director, R.R.I.C.*), and Mr. C. D. de Fonseka (*Administrative Secretary*).

1. Board.

(**a**) **Death of Sir Charles E. Jones, C.M.G.**—Before commencing the business of the day the Chairman referred to the death of Sir Charles E. Jones C.M.G. who had been a member of the Board some years ago. A vote of condolence was passed in usual manner.

(**b**) **Senator C. F. W. Wickremasinghe.**—The Chairman reported that Senator C. F. W. Wickremasinghe had returned from leave and resumed membership with effect from 1st October 1953.

2. Minutes.—Draft minutes of the Special Meeting held on 17th August and of the ordinary meeting held on 6th July 1953, which had been circulated to members, were confirmed and signed by the Chairman.

3. Experimental Committee.—Recommendations made at meeting of 3rd October 1953.

(a) **Visiting Agent's Report.**—The following recommendations were approved.

1. Staff.

(a) Appointment of an extra Asst. Clerk to the Estate Office in January 1954.

(b) Grant of a special increment to the Conductor-in-Charge, Hedigalla Experimental Station.

(b) **Research Programme for 1954.**—This was approved and the Committee's recommendations regarding the appointment of additional staff and re-arrangement of existing staff were also approved.

(c) **Agency for production of local clones.**—The recommendation that the arrangement whereby proprietary clones such as MK. 3/2, WG. 6278 and the NAB. clones are handled by the Institute on a royalty basis should be terminated was approved.

4. Reports and Accounts.

(a) **Statement of Receipts and Payments for the Quarter ended 30th June 1953** was approved.

(b) **Draft Estimates for 1954.**—Draft estimates providing for income and expenditure for 1954 as follows were approved :—

Estimated Income ...			Rs.	1,327,446
Estimated Expenditure				
Revenue	Rs.	1,261,297		
Capital	,,	572,148		
			,,	1,833,445
Estimated excess of expenditure over income			,,	505,999

(c) **Supplementary votes.**—Supplementary votes amounting to Rs. 6,231.87 were passed.

5. Staff.

(a) **Director.**—It was reported that Dr. H. E. Young had returned from leave and resumed duties as Director on 12th September. Mr. Van Emden was thanked for his services as Acting Director.

(b) **Acting Asst. Mycologist.**—It was reported that Mr. D. M. Fernando, Acting Asst. Mycologist, had returned after completing his course of training at Mc. Gill University, Canada, and had resumed duties on 21st September 1953.

(c) **Assistant Staff.**—The following changes in staff were reported:—

1. Appointment of Mr. H. L. Munasinghe as Lab. Asst. (Myco Dept.) with effect from 1st September 1953.

2. Termination of services of Mr. B. D. de A. Gurusinghe, Rubber Instructor, with effect from 30th September 1953.

3. Transfer of Mr. R. B. Madawala, Rubber Instructor, to the Dept. of Agriculture for temporary work at its rubber nurseries with effect from 1st August 1953.

6. Contributions to London Advisory Committee and British Rubber Producers' Research Association.—The proposed terms of re-organisation of the London Advisory Committee and alignment with the B.R.P.R.A. were considered and agreed to.

7. Aerial spraying of Rubber by Pest Control Ltd.—Arrangements made in connection with the proposed trial of aerial spraying for Oidium control were reported and it was noted that a grant of Rs. 100,000/- had been received from Government for this purpose.

8. London Advisory Committee.—The following documents were tabled:

(a) Annual Report for 1952.

(b) Draft minutes of meetings of the Committee, Technical Sub-Committee and Latex Sub-Committee held on 8th May, 26th March and 29th June 1953 respectively.

9. Publications.—The following publications were tabled:

Advisory Circulars No. 37, 38 and 39.
Combined 3rd & 4th Quarterly Circulars for 1952. Annual Report for 1952.

10. Minister's visit.—The Chairman reported that the Hon'ble Mr. J. R. Jayewardena, Minister of Agriculture & Food, had visited Dartonfield and Hedigalla on 24th October and that he had expressed his pleasure at the work being done by the Institute.

The meeting then terminated with a vote of thanks to the Chair.

Dartonfield,
Agalawatta.
20-1-54.

Sgd. C. D. de Fonseka,
Administrative Secretary.

RUBBER RESEARCH INSTITUTE OF CEYLON

Draft Minutes of the 124th meeting of the Rubber Research Board held at the Planters' Association Head Quarters, Colombo, at 2.30 p.m. on Monday, 21st December, 1953.

Present.—Mr. W. P. H. Dias, J.P. (*in the Chair*), Mr. G. H. Dulling, Mr. W. Herbert de Silva, Mr. R. J. Hartley, Gate Muhandiram Arthur D. S. Jayasinghe, Mr. B. Mahadeva (*Rubber Controller*), Mr. L. J. de S. Seneviratne (*Deputy Secretary to the Treasury*), Dr. H. E. Young, (*Director*) and Mr. C. D. de Fonseka (*Administrative Secretary*).

An apology for absence was received from Senator C. F. W. Wickremesinghe.

1. Board.

(a) **Mr. E. W. Whitelaw.**—The Chairman referred to the death of Mr. E. W. Whitelaw who had been a member of the Board for a number of years before his retirement from Ceylon and was at the time of his death the Chairman of the London Advisory Committee for Rubber Research (*Ceylon & Malaya*). His death was a geat loss to the Board and to the rubber industry in general. A vote of condolence was passed in the usual manner and it was noted that the condolences of the Board and the Staff had already been conveyed to the late Mr. Whitelaw's widow and family through the L.A.C.

(b) **Amendment to the Rubber Research Ordinance.**—The Chairman reported that the Ordinance had been amended to provide for inclusion of the Rubber Controller as an ex-officio member of the Board. He welcomed Mr. B. Mahadeva, Rubber Controller, who was present.

2. Minutes.

(a) **Confirmation.**—Draft minutes of the meeting held on 21st December, 1953, which had been circulated to members, were confirmed by the Chairman.

(b) **Matters arising from the minutes.**

1. Research Assistant (Bot. Dept.).—Reported that the Sub-Committee appointed at the last meeting had interviewed candidates for this post and offered the appointment to Mr. L. B. Chandrasckera, B.Sc. (Ceylon) who was expected to assume duties on 2nd January 1954.

3. Reports and Accounts

(a) **Balance Sheet and Auditor General's Report for 1952.**—were approved.

(b) **Revotes.**—Unspent balances of Capital Votes for 1952 amounting to Rs. 463,008.51 were revoted for 1953.

(c) **Statement of Receipts and Payments for the 3rd Quarter 1953.**—was approved.

4. Staff.

(a) **Mycologist.**—A letter from Ir. J. H. Van Emden, Mycologist, giving six months' notice of resignation with effect from 7th December 1953 was read.

(b) **Assistant Staff.**

1. Changes in staff.—The appointment of Mr. E. G. Mendis as Lab. Assistant (Myco Dept.) with effect from 1st November 1953 was reported.

2. Loans for purchase of transport.—Reported that loans of Rs. 1950/- and Rs. 1500/- respectively had been granted to the Rubber Instructors of Talpe and Talangama for the purchase of motor cycles.

3. Medical Certificates.—It was agreed that Medical Certificates from registered and qualified medical practitioners may be accepted to cover sick leave when the officer concerned is too ill to go to a Government Medical Officer for a certificate. This decision is subject to revision later if found necessary.

5. London Advisory Committee.

(a) **Ceylon Government Representative.**—It was reported that Mr. C. A. Meakin had been appointed as the Ceylon Government Representative on the London Advisory Committee in place of the late Mr. E. W. Whitelaw with effect from 1st January 1954. The Board concurred in this appointment.

(b) **Minutes of the 6th meeting of the Executive Committee held on 2nd October 1953.**—were tabled.

6. Rubber Conference.—Comments from members and others who had attended the Conference on 16th November were read and it was noted that the Conference was generally considered to be a success. Possible improvements in arrangements for future Conferences were discussed.

7. Conference of Staff of Research Institutes in the Far East held at Bogor, Indonesia.—A copy of the printed report on the proceedings of this Conference was tabled.

The Chairman wished members a happy Christmas and a prosperous New Year.

The meeting terminated with a vote of thanks to the Chair.

(*Sgd.*) C. D. De Fonseka,
Administrative Secretary.

Dartonfield,
Agalawatta.
19-1-54.

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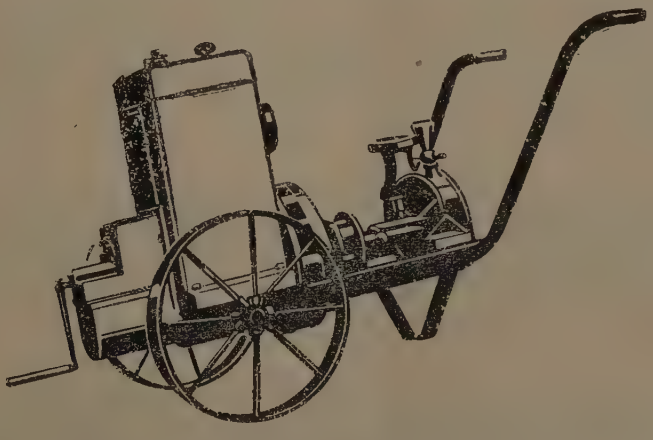

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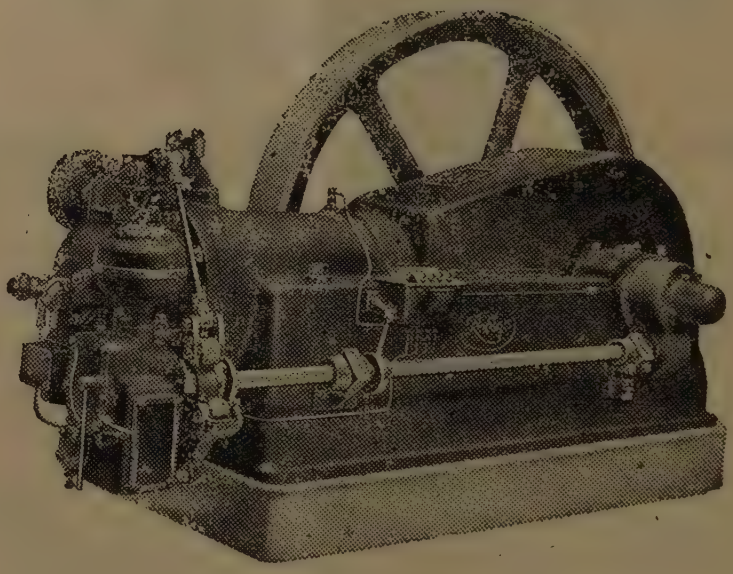

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